

# Italy team

Institutions involved:

INFN,

Università di Firenze, Università di Milano-Bicocca,  
Università di Pavia, Università di Roma Tre, Università di Ferrara

Vittorio Del Duca

INFN Laboratori Nazionali Frascati

LHCPhenoNet Mid-Term Meeting

18 September 2012

## Team composition

- Vittorio Del Duca, INFN LNF  
Gennaro Corcella, INFN LNF  
Vladimir A. Smirnov, NPI Moscow  
staff, team coordinator  
staff  
visiting researcher
- Stefano Catani, INFN Firenze  
Leandro Cieri, INFN Firenze & U. Buenos Aires  
Dimitri Colferai, U. Firenze  
Alessandro Niccoli, U. Firenze  
ESR in  
staff  
PhD  
PhD & ESR out
- Paolo Nason, INFN Milano-Bicocca  
Giancarlo Ferrera, U. Milano  
Giuseppe Marchesini, U. Milano-Bicocca  
Carlo Oleari, U. Milano-Bicocca  
staff  
staff  
staff  
staff  
Adam Kardos, U. Debrecen & INFN Milano-Bicocca  
ESR in (from January 2013)
- Fulvio Piccinini, INFN Pavia  
Oreste Nicrosini, INFN Pavia  
Guido Montagna, U. Pavia  
staff  
staff  
staff  
staff  
Carlo Carloni-Calame, INFN & U. Pavia  
Giovanni Balossini, INFN & U. Pavia  
postdoc  
Luca Barzè, INFN & U. Pavia  
PhD  
Christopher Bignamini, INFN & U. Pavia  
PhD  
Mauro Chiesa, INFN & U. Pavia  
PhD  
Valeria Prosperi, INFN & U. Pavia  
PhD
- Giuseppe Degrassi, U. Roma Tre  
staff  
Guido Altarelli, U. Roma Tre  
staff  
Stefano Di Vita, U. Roma Tre  
PhD
- Mauro Moretti, U. Ferrara  
staff

## Team expertise

- the team consists of leading INFN & University researchers in theoretical particle physics, with expertise in collider physics, QCD, SM and BSM phenomenology.
- the team has been contributing to the following physics tasks:
  - Multi-jet matrix element generators
  - Shower Monte Carlo generators
  - Matching shower Monte Carlo and NLO computations
  - Numerical NLO computations
  - General methods for computing jet cross sections at NNLO
  - Techniques for multi-loop calculations of matrix elements
  - QCD threshold and transverse-momentum resummations
  - Heavy quark production
  - Vector boson production
  - Higgs boson production and Higgs couplings within and beyond the SM
  - Backgrounds to BSM processes
  - Neutrino mixing
- the team benefits from the world-leading expertise of V.A. Smirnov on multi-loop computations

## Training and research environment

- The members of the team are actively engaged in research, and in teaching and tutoring at graduate and undergraduate level at the Uni. of Ferrara, Firenze, Milano-Bicocca, Pavia and Roma Tre
- Uni. of Ferrara and Pavia run a program for international students <http://iuss.unife.it/scholarships-for-international-students>
- INFN Firenze is involved in the organisation of the Galileo Galilei Institute (GGI) recently it has organised the GGI Workshop on ``High-energy QCD after the start of the LHC" in Autumn 2011
- INFN LNF organises the LNF Spring School bi-yearly, lately in May 2012 it has organised the LHCPhenoNet School of Analytic Computing in Theoretical High-Energy Physics

# SCHOOL OF ANALYTIC COMPUTING IN THEORETICAL HIGH-ENERGY PHYSICS

OCTOBER 7-11, 2011 - ATRANI, ITALY



[WWW.LHCPHENONET.EU/ATRANI2011](http://WWW.LHCPHENONET.EU/ATRANI2011)

## SCIENTIFIC PROGRAMME

SIMON CARON-HUOT (IAS PRINCETON)  
JOHANNES HENN (IAS PRINCETON)  
LUIS F. ALDAY (MATH. INST. OXFORD)  
CLAUDE DUHR (ETH ZÜRICH)  
HENRIK JOHANSSON (CEA SACLAY)  
VLADIMIR SMIRNOV (NPI MOSCOW)

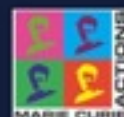
AMPLITUDES AT WEAK COUPLING  
WILSON LOOPS AT WEAK COUPLING  
AMPLITUDES AT STRONG COUPLING  
MOMENTUM TWISTORS, SPECIAL FUNCTIONS AND SYMBOLS  
N=4 SYM AND N=8 SUPERGRAVITY AMPLITUDES  
MODERN METHODS FOR MULTILOOP FEYNMAN INTEGRALS

## INTERNATIONAL ADVISORY COMMITTEE

NIMA ARKANI-HAMED (IAS PRINCETON)  
LANCE DIXON (SLAC STANFORD)  
THOMAS GEHRMANN (UNIVERSITÄT ZÜRICH)  
GREGORY KORCHEMSKY (CEA SACLAY)  
JUAN MALDACENA (IAS PRINCETON)  
GERMAN RODRIGO (IFIC VALENCIA)

## LOCAL ORGANIZING COMMITTEE

VITTORIO DEL DUCA (INFN FRASCATI)



LHCphenonet



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# School of Analytic Computing in Theoretical High-Energy Physics

Atrani, Italy, 6-11 October 2011  
<http://www.lhcphenonet.eu/atrani2011>

Simon Caron-Huot  
Johannes Henn  
Luis F. Alday  
Claude Duhr  
Henrik Johansson  
Volodya Smirnov

*Aspect of scattering amplitudes*  
*Wilson loops in  $N=4$  SYM*  
*Scattering amplitudes at strong coupling*  
*Momentum twistors, special functions and symbols*  
 *$N=4$  SYM and  $N=8$  supergravity amplitudes*  
*Modern methods for multiloop Feynman integrals*

27 PhD students and postdocs, 23 lectures.





# ESR papers

**LPN12-082**

**Diphoton spectrum in the mass range 120-140 GeV at the LHC**

**by Leandro Cieri**

**also available as [arxiv: 1207.3252](#)**

**LPN12-xxx**

**Vector boson production at hadron colliders: hard-collinear coefficients at the NNLO**

**by Stefano Catani, Leandro Cieri, Daniel de Florian, Giancarlo Ferrera, Massimiliano Grazzini,**

**also available as [arxiv: 1209.0158](#)**

**22 more papers by team members**

## 22 papers by team members

### LPN11-18

The massless hexagon integral in  $D=6$  dimensions  
by Vittorio Del Duca, Claude Duhr, Vladimir A. Smirnov  
also available as [arxiv: 1104.2781](#)  
Published in: *Phys. Lett. B* 703: (2011) 363–365.

### LPN11-21

The One-Loop One-Mass Hexagon Integral in  $D=6$  Dimensions  
by Vittorio Del Duca, Claude Duhr, Vladimir A. Smirnov  
also available as [arxiv: 1105.1333](#)  
Published in: *JHEP* 07: (2011) 064.

### LPN11-23

The one-loop six-dimensional hexagon integral with three massive corners  
by Vittorio Del Duca, Lance J. Dixon, James M. Drummond, Claude Duhr, Johannes M. Henn, Vladimir A. Smirnov  
also available as [arxiv: 1105.2011](#)  
Published in: *Phys. Rev. D* 84: (2011) 045017.

### LPN11-25

NNLO leptonic and hadronic corrections to Bhabha scattering and luminosity monitoring at meson factories  
by C.Carloni Calame, H.Czyz, J.Gluza, M.Gunia, G.Montagna, O.Nicrosini, F.Piccinini, T.Riemann, M.Worek  
also available as [arxiv: 1106.3178](#)  
Published in: *JHEP* 1107 : (2011) 126.

### LPN11-40

VBFNLO: A parton level Monte Carlo for processes with electroweak bosons -Manual for version 2.5.0  
by K.Arnold, J.Bell, G.Bozzi, M.Brieg, F.Campanario, C.Englert, B.Feigl, J.Frank, T.Figy, F.Geyer, C.Hackstein, V.Hankele, B.Jaeger, M.Kerner, M.Kubocz, C.Oleari, S.Palmer, S.Plaetzer, M.Rauch, H.Rzehak, F.Schissler, M.Spannowsky, M.Worek, D.Zeppenfeld  
also available as [arxiv: 1107.4038](#)

### LPN11-49

An infrared approach to Reggeization  
by Vittorio Del Duca, Claude Duhr, Einan Gardi, Lorenzo Magnea, Chris D. White  
also available as [arxiv: 1108.5947](#)



**LPN11-50**

**Reggeization from the structure of infrared singularities in non-abelian gauge theories**  
by Vittorio Del Duca, Claude Duhr, Einan Gardi, Lorenzo Magnea, Chris D. White  
also available as [arxiv: 1109.3581](#)  
Published in: *JHEP* 1112: (2011) 021.

**LPN11-73**

**Transverse-momentum resummation: Higgs boson production at the Tevatron and the LHC**  
by Daniel de Florian, Giancarlo Ferrera, Massimiliano Grazzini, Damiano Tommasini  
also available as [arxiv: 1109.2109](#)  
Published in: *JHEP* 1111: (2011) 064.

**LPN11-74**

**Diphoton production at hadron colliders: a fully-differential QCD calculation at NNLO**  
by Stefano Catani, Leandro Cieri, Daniel de Florian, Giancarlo Ferrera, Massimiliano Grazzini  
also available as [arxiv: 1110.2375](#)  
Published in: *Phys. Rev. Lett.* 108: (2012) 072001.

**LPN11-77**

**Associated WH production at hadron colliders: a fully exclusive QCD calculation at NNLO**  
by G. Ferrera, M. Grazzini, F. Tramontano  
also available as [arxiv: 1107.1164](#)  
Published in: *Phys. Rev. Lett.* 107: (2011) 152003 .

**LPN11-94**

**Space-like (vs. time-like) collinear limits in QCD: is factorization violated?.**  
by Stefano Catani, Daniel de Florian, German Rodrigo  
also available as [arxiv: 1112.4405](#)  
Published in: *JHEP* 1207: (2012) 026.

**LPN12-001**

**Higgs boson production at hadron colliders: hard-collinear coefficients**  
by S. Catani, M. Grazzini  
also available as [arxiv: 1106.4652](#)  
Published in: *Eur. Phys. J. C* 72: (2012) 2013.

**LPN12-031**

**Implementation of electroweak corrections in the POWHEG BOX: single W production**  
by Luca Barze, Guido Montagna, Paolo Nason, Oreste Nicrosini and Fulvio Piccinini  
also available as [arxiv: 1202.0465](#)

**LPN12-032**

**Probing higher-order corrections in dijet production at the LHC**  
by S. Alioli, J. Andersen, C. Oleari, E. Re and J. Smillie  
also available as [arxiv: 1202.1475](#)

**LPN12-057**

**Tree-Loop Duality beyond single poles**  
by Isabella Bierenbaum, Sebastian Buchta, Stefano Catani, Petros Draggiotis, Ioannis Malamos, German Rodrigo

**LPN12-064**

**The SM and SUSY after the 2011 LHC results**  
by Guido Altarelli  
also available as [arxiv: 1206.1476](#)

**LPN12-065**

**Tri-Bimaximal Neutrino Mixing and Discrete Flavour Symmetries**  
by Guido Altarelli, Ferruccio Feruglio, Luca Merlo  
also available as [arxiv: 1205.5133](#)

**LPN12-066**

**Discrete Flavour Groups,  $\theta_{13}$  and Lepton Flavour Violation**  
by Guido Altarelli, Ferruccio Feruglio, Luca Merlo, Emmanuel Stamou  
also available as [arxiv: 1205.4670](#)

**LPN12-067**

**The Mystery of Neutrino Mixings**  
by Guido Altarelli  
also available as [arxiv: 1111.6421](#)

**LPN12-069**

**Anomalous Couplings in Double Higgs Production**

**by R. Contino, M. Ghezzi, M. Moretti, G. Panico, F. Piccinini, A. Wulzer**

**also available as [arxiv: 1205.5444](#)**

**LPN12-077**

**Higgs boson production at the LHC: transverse momentum resummation effects in the  $H \rightarrow 2\gamma$ ,  $H \rightarrow WW \rightarrow l\nu l\nu$  and  $H \rightarrow ZZ \rightarrow 4l$  decay modes.**

**by Daniel de Florian, Giancarlo Ferrera, Massimiliano Grazzini, Damiano Tommasini**

**also available as [arxiv: 1203.6321](#)**

**Published in: *JHEP* 1206: (2012) 132.**

**LPN12-078**

**Release Note Vbfnlo-2.6.0**

**by K. Arnold, J. Bellm, G. Bozzi, F. Campanario, C. Englert, B. Feigl, J. Frank, T. Figy, B. Jäger, M. Kerner, M. Kubocz, C. Oleari, S. Palmer, M. Rauch, H. Rzehak, F. Schissler, O. Schlimpert, M. Spannowsky, D. Zeppenfeld**

**also available as [arxiv: 1207.4975](#)**